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ABSTRACT

Twenty 3-year-old, home reared, Down's Syndrome children and eight 3-year-old normal children were studied to examine the verbal learning characteristics of Down's Syndrome children in typical preschool learning tasks. Prior to the study, research on characteristics of verbal learning deficits in retarded individuals and on verbal skill training was reviewed. A hierarchy of teaching strategies (verbal prompt, verbal instruction, imitation plus verbal instruction, and manual guidance plus verbal instruction) was used in teaching 16 self-help and preacademic tasks. Approximately 40-50 percent of the tasks were not solved by Down's Syndrome Ss with verbal prompting plus verbal instruction alone. Only 14 percent of the tasks were not solved by normal Ss at the same levels of instruction. Despite additional trials, which were enriched with verbal instruction and made more direct through the use of imitation and manual guidance strategies, Down's Syndrome Ss failed to acquire task solution more than 25 percent of the time. Verbal learning deficits seemed to lie largely in the auditory or integration phases of the task and only minimally in the motor output phase. (GW)

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THE SEVERE NATURE OF VERBAL LEARNING DEFICITS IN PRESCHOOL DOWN'S SYNDROME (MONGOLOID) CHILDREN

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3. S. Fisher, D. Moores, & M. J. Harlow. Post secondary programs for the deaf: III. Internal view. Research Report #67.

4. W. Bart. A set-theoretic model for the behavioral classification of environments. Occasional Paper #29. July 1974

5. D. Krus, W. Bart, & P. Airasian. Ordering theory and methods. Occasional Paper #28. July 1974.

6. B. Egeland & A. Thibodeau. Selective attention of impulsive and reflective children. Research Report #66. July 1974.

7. R. Hoffmeister, B. Best, & D. Moores. The acquisition of sign language in deaf children of deaf parents: Progress Report. Research Report #65. June 1974.

8. P. Krus. Use of family history data to predict intellectual and educational functioning longitudinally from ages four to seven. Research Report #64. June 1974.

9. P. Krus. Analyzing the individual differences in evaluating compensatory education programs. Occasional Paper #27. June 1974.

10. J. Rondal. The role of speech in the regulation of behavior. Research Report #63. June 1974.

11. M. Buium, J. Rynders, & J. Turnure. A semantic-relational-concepts based theory of language acquistion as applied to Down's Syndrome children: Implication for a language enhancement program. Research Report #62. May 1974.

12. D. Moores, M. Harlow, & S. Fisher. Post secondary programs for the deaf: II. External view. Research Report #61. March 1974.

13. D. Moores, M. Harlow, & S. Fisher. Post secondary programs for the deaf: I. Introduction and overview. Research Report #60. March 1974.

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16. A. Taylor, M. Thurlow & J. Turnure. Elaboration as an instructional technique in the vocabulary development of EMR children. Research Report #59. March 1974.

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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

The Severe Nature of Verbal Learning Deficits in Preschool Down's Syndrome (Mongoloid) Children[1,2,3]

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Without question retarded children exhibit deficits in verbal learning abilities, e.g., deficits in following verbal commands, and recalling stimulus materials presented as paired associates (c.f., McLean, Yoder and Schiefelbusch, 1972). However, there has been little systematic study of how severe and pervasive these deficits might be in Down's Syndrome and other retarded children, especially in ordinary school tasks. This lack of study is most unfortunate since school programs for retarded children often rely heavily on verbal instruction techniques, assuming that retarded pupils have the ability to at least input and process verbally presented material. The present study will show that heavy reliance on verbal instruction for retarded children can be a serious educational error.

The purpose of the present investigation was to examine the verbal learning characteristics of Down's Syndrome children in typical preschool learning tasks in which the conditions of learning

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[1]This study was supported under a grant to the University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children (OEG-0-9-332189-4533-032) from the U.S. Office of Education.

[2]Thanks are due Kay Zwernik, Director of North Suburban Day Activity Center for assistance in pilot testing the tasks involved in the present study.

[3]This report is based on a paper presented at the national convention of the American Association on Mental Deficiency (AAMD), Toronto, Canada, June, 1974. It is also based, in part, on the Masters Theses of Lisa M. Wangsness and Julie G. Swanson.

are carefully structured and where verbal instruction is augmented with non-verbal instruction.

Before describing the study, let us look briefly at the characteristics of verbal learning deficits in retarded individuals, especially Down's individuals, and at attempts to foster verbal learning skills in them.

Verbal Learning Deficits in Retarded Individuals

Verbal learning involves the input, integration and output of language and language-linked material. Since the present study was focused upon language input and integration only, a discussion of language output will be omitted.

Mentally retarded children have been described as delayed in a wide array of verbal learning functions such as verbal association, generalization, discrimination, and manipulation of verbal concepts (Schlanger, 1967).

In explaining differences in cognitive organizational strategies (i.e., the integration of verbal messages) of retarded and nonretarded children, Semmel (1967) suggests that two fundamental and qualitatively different strategies are involved: (1) the sequential-associative strategy and (2) the hierarchical strategy. Sequential-association results in a simple stimulus-response association on sequentially dependent chains; hierarchical processing results in formation of a structured network of concepts, classes, systems, and relationships. The latter involves abstraction of

common attributes in order to form generalized internal representations. Mentally retarded children tend to use the more primitive sequential-associative strategy when processing language, while both the hierarchical and sequential-associative strategies are used by normal children. Support for Semmel's position has been demonstrated by Semmel, Barritt, and Bennett (1970), Semmel, Barritt, Bennett, and Perfetti (1968), Semmel and Bennett (1970), and Sitko (1970).

Luria (1963) states that the ability to make use of knowledge obtained in the course of speech instructions in a generalized form and the ability to use speech as a means of independent thinking are characteristically lacking in retarded children. Luria notes also that the integration of speech (commands) and action is difficult for retarded children, and that spoken instruction does not always lead to the performance of the necessary task.

Regarding verbal learning deficits in Down's Syndrome children, Cornwell & Birch (1970) studied 44 home-reared Down's Syndrome children and found that they exhibited deficits in language skills, particularly in skills related to concept formation, abstraction, and higher integrative abilities.

Bilovsky and Share (1965) administered the Illinois Test of Psycholinguistic Abilities (ITPA) to Down's Syndrome children finding, within each channel (decoding, association, and encoding), that the greatest deficits appeared in the auditory decoding and verbal encoding channels. On the basis of their data, they speculated

that Down's Syndrome children may be especially limited in their ability to process verbal material.

Studies of Down's individuals by Hermelin and Venables (1964), Nakamura (1965), Scheffelin (1968), and Thompson (1963) also reveal marked verbal learning deficits.

Hermelin and Venables, assessing the reaction time of Down's individuals, showed them to have slower motor reactions to auditorily presented material, as compared with non-Down's Syndrome retarded adults, indicating an impaired ability to input and/or process auditory material.

Nakamura compared 64 institutionalized Down's Syndrome adults with 64 non-Down's Syndrome retarded adults matched for age, sex, and I.Q. and found that there were no significant differences between groups on 56 of the 60 sub-items on the Stanford Binet. However, more Down's Syndrome subjects passed three of the remaining sub-items, all of which involved visuomotor performance, while the sub-item on which the non-Down's Syndrome subjects did better was "repeating three digits," an auditory-vocal problem.

Scheffelin assessed the relative strength of visuomotor, visuovocal, auditory-motor, and auditory-vocal processes with 24 noninstitutionalized Down's Syndrome children. The error rate for the auditory-vocal task was twice that for the other three, among which there were no significant differences.

Thompson (1963), in her study of five- and six-year-old Down's Syndrome children, classified activities into four areas according

to the amount of language used in the request and in the response. The classifications were: a) little or no language used in the directions and none in the response; b) verbal directions, non-verbal response; c) verbal directions requiring a verbal reply, but supplemented by concrete material; and d) verbal directions requiring a verbal response with no supplemental materials. Children in Thompson's study responded best to the items classified as "a" and "b." Interestingly, she found that Down's Syndrome children were either capable of exploiting the obvious potentialities of the early preschool material on their own initiative or of comprehending what was required after direction or demonstration, a point which leads us to the next section in which we shall look briefly at some studies which have employed verbal guidance, imitation or manual guidance techniques, the teaching strategies of concern in the present study.

Attempts to Induce Learning through Modeling, Manual Guidance and Verbal Guidance

Turnure and Rynders (1973) recently reviewed studies which employed modeling, manual guidance and verbal guidance techniques with both young children and retarded individuals. They found that the relative efficacy of the various instructional procedures in these studies appears to lean toward the more direct approaches, but note that the picture is one of unclear aptitude x treatment x task interactions.

Beginning with some of the early research, Turnure and Rynders' review indicates that manual guidance produces substantial increments in performance over trial and error for children learning stylus mazes (Melcher, 1934), or learning to write (Gates and Taylor, 1923). More recently, Zaporozhets (1960) found that the success of various training procedures was linked to the child's motivation, his age, and the nature and complexity of the task. A recent study in Zaporozhets' series (Nepomniashchaia, 1965) demonstrated that normal children below the age of 4 1/2 generally took up a task only if it was presented to them as a game to be carried out for its own sake. As they matured, they developed the capacity to recognize actions as prerequisites for the later fulfillment of motives (e.g., making a gift to give to mother). With regard to instructional strategy and the child's age and task complexity, Zaporozhets found that verbal instruction appeared to be more effective when the required bodily movements were relatively simple and when external stimuli were of particular importance (e.g., in button-pressing tasks). Modeling worked better when proprioceptive stimuli were important and when the required movements were complex (e.g., in gymnastic exercises). He also found that passive movement (manual guidance) was generally more helpful with younger children, and modeling with older (cf., Lisina & Neverovich, 1971).

Church (1970) also observed a definite link between a child's age and the suitability of a particular teaching strategy. In

teaching infants to turn on a light by tugging on a pull-chain, he described the efficacy of a manual guidance technique:

> Babies between the ages of nine and fifteen months characteristically touched, pushed, pulled, or twisted the bulb itself, as though direct action would make it work. A few babies in this range tried to use the string, but without success. When the subject could not work the switch, I proceeded to two levels of training. First, I demonstrated again the correct procedure, moving my hand slowly and exaggeratedly. This procedure worked with a number of babies in the one-to-two year range. If it did not work, I folded the baby's hand around the string, clasped his hand in mine, and worked the switch in this way. This technique was successful with all babies past a year in age [1970, pp. 14-15].

Turnure and Rynders (1973) presented a problem to three groups of institutionalized retarded children involving the use of a stick as a tool in acquiring an object (a bag of candy) beyond normal reach, a problem-solving task originated by Kohler (1925). Individuals were assigned at random to one of three conditions: (1) Trial and error (Verbal prompt), (2) Modeling, or (3) Manual guidance. Results showed that both imitation and manual guidance were significantly different from trial and error (trial and error individuals doing more poorly), but results of using imitation and manual guidance did not differ significantly. In this study the authors did something interesting after the experiment proper was completed: Eight individuals in the trial and error condition who had not secured the prize were retested in the manual guidance condition. Of these eight previously unsuccessful trial and error learners, seven secured the prize within a single 20 second trial after the manual guidance training.

The technique of evoking desirable new behavior by means of manual guidance also has clear training implications for enhancing "self help" skills of response-impoverished subjects, e.g., normal infants and retarded individuals of all ages (cf., Bensburg & Slominski, 1965; Bricker & Bricker, 1970; Church, 1970; Frichtl & Peterson, 1970; Hasazi, Streifel, & Edgar, 1971; Rynders & Friedlander, 1971; Sidman & Stoddard, 1966). A word of caution regarding manual guidance is in order, however: Because manual guidance requires the physical manipulation of another individual, a strong word of caution against any excess in its use must be included. Without a doubt, the use of manual guidance with unwilling individuals would be altogether inappropriate. In such cases, where individuals may be resistant to manual guidance, appropriate modeling or shaping techniques might well be employed. In fact, at least one study reports that some institutionalized retardates actively resist manual manipulation (Baer, Peterson & Sherman, 1967). In cases where manual guidance is resisted, the basis for the resistance, such as fear or mistrust, should be determined and efforts extended towards the elimination of the causes of the negative attitude.

So far, the discussion has favored the application of more direct instructional techniques, but this should not be construed to imply that manual guidance and imitation are the only direct methods of guidance with any value for inducing certain behaviors. On the contrary, Carr (1930) included several categories in his

discussion of "direct guidance" and found verbal guidance to be the most efficient method, a finding recently replicated by Masters and Branch (1969). Unfortunately, very young normal children, and severely retarded individuals are often incapable of comprehending verbal directions and performing tasks without further, more direct, assistance.

Restrictions on the appropriateness of verbal guidance methods, however, may be even more extensive, although less obvious, than this. Advocates of the "inquiry method of learning," a method typified by extreme if not exclusive reliance on the posing of questions as a method of instructional guidance (Estvan, 1971), surely realize that an interrogative statement may be incomprehensible for infants and most institutionalized retardates who may lack even the most rudimentary receptive language skills. But beyond this limiting case, it appears that interrogative statements as an instructional technique may be less conducive to learning than expository statements for retarded children. Thurlow and Turnure (1972), for example, recently found the verbal learning of mildly retarded children to be significantly poorer on materials presented in interrogative contexts, as compared with declarative or imperative contexts.

In summing up this section, retarded individuals, including Down's Syndrome individuals, exhibit marked verbal learning deficiencies in a broad range of learning tasks. Hence, they are likely to be greatly disabled in a classroom setting where the majority of the

instruction is verbal. In this vein, Lovitt and Smith (1972) note that teachers use varied types of instruction in their efforts to teach exceptional children, however, these instructions usually take a verbal form, e.g., verbal prompts or requests from the teacher. They suggest that verbal instruction may need to be coupled with or supplanted by other teaching strategies, such as modeling if a desired behavior is to be induced. Such coupling of strategies is precisely what was done in the study about to be described.

METHOD

Subjects

Subjects (Ss) in the present study were twenty, three-year-old home-reared Down's Syndrome children and eight, three-year-old normal children. All Ss are part of a longitudinal study (Project EDGE)[4] which is focused on the communication development of Down's Syndrome children (Rynders and Horrobin, 1972). IQ scores of Down's Syndrome children, all of whom were karyotyped and found to have the nondisjunction type of Down's Syndrome, ranged from 78 - 39, with a mean of 65.6. IQ scores of the normal children ranged from 96 - 138, with a mean of 117. All Ss were tested using the Cattel-Binet or Bayley Scales of Infant Development. The EDGE Assessment, the measure of verbal learning, was given to all Ss within two weeks of their third birthday.

Instrument and Procedure

The EDGE Assessment includes sixteen tasks which fall into two general areas designated as self-help and preacademic (see Table 1). Tasks were administered in four prerandomized orders so as to control for possible fatigue effects. (A few tasks, however, were always given in a fixed sequence. For example, closing the door and hanging a jacket were always administered as soon as the

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[4] E.D.G.E. stands for Expanding Developmental Growth through Education, the title of a longitudinal study of communication development in Down's Syndrome children. The study, directed by Rynders and Horrobin, is funded through the RD&D Center in Special Education, Grant (OEG-0-9-332189-4533-032), in the Department of Special Education, University of Minnesota.

child entered the room; choosing a crayon was always done before crayon drawing; and pouring juice, a natural culminating activity, was always the final task.) The assessment was administered by two experimenters (Es), each presenting half of the tasks. One E always served as "teacher," while the other did the scoring. Before administering the measure, pilot testing was done at the North Suburban Day Activity Center in St. Paul, Minnesota, with three- and four-year-old retarded children. As a result of pilot testing, the directions were sharpened and some items were added, dropped and altered.

An invariant, four-part hierarchy of teaching strategies (1) verbal prompt, (2) verbal instruction, (3) imitation plus verbal instruction, (4) manual guidance plus verbal instruction was used in each task, a technique suggested by Turnure and Rynders (1973) as a result of their finding that modeling and/or manual guidance instruction was highly successful, as contrasted with trial and error procedures, in inducing task solutions in institutionalized retarded children. A hierachy was also employed in the present study because (a) it permitted the child to assert his own problem solving ability to the maximum extent so as to foster independent problem solving ability; and (b) it permitted verbal instruction to be presented first and then, if a solution did not occur, to be augmented by increasingly more direct methods. In this vein Turnure and Rynders point out that manual guidance (the final step in the instructional hierarchy of the present study) virtually eliminates

Table 1

Tasks in the EDGE Assessment

	Task	Spontaneous Solution Opportunity Offered	Position bias controlled for
1.	Closing the door	no	no
2.	Hanging coat on hook	no	no
3.	Concept of size (discrimination of bigger)	no	yes
4.	Squeezing a toy to make it "squeak"	yes	no
5.	Matching cut out shapes to insets	yes	yes
6.	Playing the piano	yes	no
7.	Color recognition	no	yes
8.	Placing pegs in a peg board	yes	no
9.	Crayon choosing	yes	no
10.	Crayon drawing	yes	no
11.	Memory task (a variation of the ancient shell game)	yes	yes
12.	Block building (piling blocks)	yes	no
13.	Problem solving (wooden puzzle)	yes	no
14.	Hammering a peg into a peg hammer board	yes	no
15.	Quantity (discrimination between most and least)	no	yes
16.	Pouring juice into a glass	yes	no

the problem in a problem solving situation because it results in a "temporal collapse" of the problem by juxtaposing means and ends directly, at the same moment, and also a "spatial collapse" of the problem by bringing stimulus elements into close and conclusive proximity at that moment. Thus, conceptually, a child enters the present hierarchy with virtually no instruction and, if necessary, receives instruction which at the very least simulates the desired terminal response.

Verbal Prompt (VP). For most tasks S was offered a chance to solve a given problem spontaneously. This was done to determine whether the child might already have the solution in his repertoire. A chance for spontaneous solution, through verbal prompting, was provided only in instances where the task and materials themselves suggested the full and complete solution. (See Table 1 for a list of prompted and non-prompted tasks.) In prompted instances, task elements were presented to S, and E said, "Go ahead."

Verbal Instruction (VI). In this strategy, E presented the materials to the child and verbally explained, with an imperative sentence, how the child was to perform the task. For example, "Close the door."

Imitation plus Verbal Instruction. E instructed S to "Watch me, and I will show you what to do." As E performed the actions involved in the task, she verbally explained what she was doing, "See, I am closing the door." Then she positioned the task elements in front on the child and said, "Now, you do it."

Manual Guidance Plus Verbal Instruction. While verbally explaining what S and E were doing together, E physically guided the child through the motions necessary to successfully complete the task, "I will help you. I am helping you close the door." Then the materials were once again presented and S was told, "Now, you do it."

For each task, and during each of the four strategies, S was allowed fifteen seconds to make a correct response, with the exception of the puzzle task for which thirty seconds were allowed. An observer (E who was not teaching) timed each strategy, beginning when the instructions were completed, and also recorded each response as correct (+) or incorrect (-) according to specific behavioral criteria for each task. The observer signaled E whenever criterion was reached on a task. At the end of each fifteen second period, the observer signaled E by saying "Stop." When a task was successfully completed at one of the strategy levels in the hierarchy the task was terminated and a correct solution was noted for the particular teaching strategy. If a child exhausted the entire hierarchy (VP and/or VI, then imitation plus VI, then manual guidance plus VI) without reaching the operationally defined criterion for each task, a notation of "non-solution" was recorded for the given task. E then proceeded directly to the next task until all 16 were given.

Because of the ages of Ss, termination rules were quite global -- permitting termination only if a child refused to participate

in any way, even participating from his mother's lap, on three tasks consecutively. Fortunately, the termination rules were adequate, and no S required exclusion.

In some tasks (see Table 1) there was a possibility of a position bias (side preference); therefore, in these tasks, stimulus elements were alternated so that the correct response appeared on the left or right side alternatively for each teaching strategy and across tasks. Then, if S responded only to his right or his left side, all tasks with position bias possibilities were excluded from the experiment for that S. None of the Ss were found to have a position bias which required task exclusion.

Testing was conducted in a room in which all furnishings had been removed except for a small round table and two chairs (at which E and S sat), a chair for the observer, videotaping equipment, and a suitcase containing stimulus materials.

The EDGE Assessment was not intended to be a formal test. Therefore, no attempts have been made to factor analyze its items. Its sole purpose was to reveal verbal learning deficits in a way that could possibly illuminate their nature if they existed. In the present authors' judgment, existing items from tests, such as published achievement tests and vocational aptitude tests could be adapted to accommodate the procedures employed in the present study rather than expending a great deal of effort on the norming and standardizing of the present set of items. Be that as it may,

we were interested in inter-rater reliability as a procedural necessity. This measurement was derived from video-taped EDGE Assessment sessions on pilot Ss in which the entire hierarchy was presented for each task. Two research assistants viewed independently the entire presentation of four complete administrations (64 tasks) and scored them as to where success was achieved in the hierarchy, according to the protocol-defined (operationally defined) criterion of success. The percentage of agreement across 64 tasks was 86 per cent.

A Condition of Repeated Verbal Instruction

For six Down's Ss, the measure was given with repeated verbal instruction in place of modeling and manual guidance. This group served as a contrast group since, without it, the added power, if any, of more direct techniques (modeling and manual guidance) could be masked. Furthermore, since it is not inconceivable that modeling and manual guidance might actually serve as "detractors" rather than "enhancers" in the tasks of the present study, the condition of repeated verbal instruction served as a means of studying possible distracting effects of these techniques.

RESULTS

We will look first at results comparing normal and Down's children in the four-part hierarchial condition.

For analysis purposes instances of successful task completion at a verbal prompt level were combined with instances of success at the verbal instruction (VP + VI) level because not all tasks included verbal prompting.

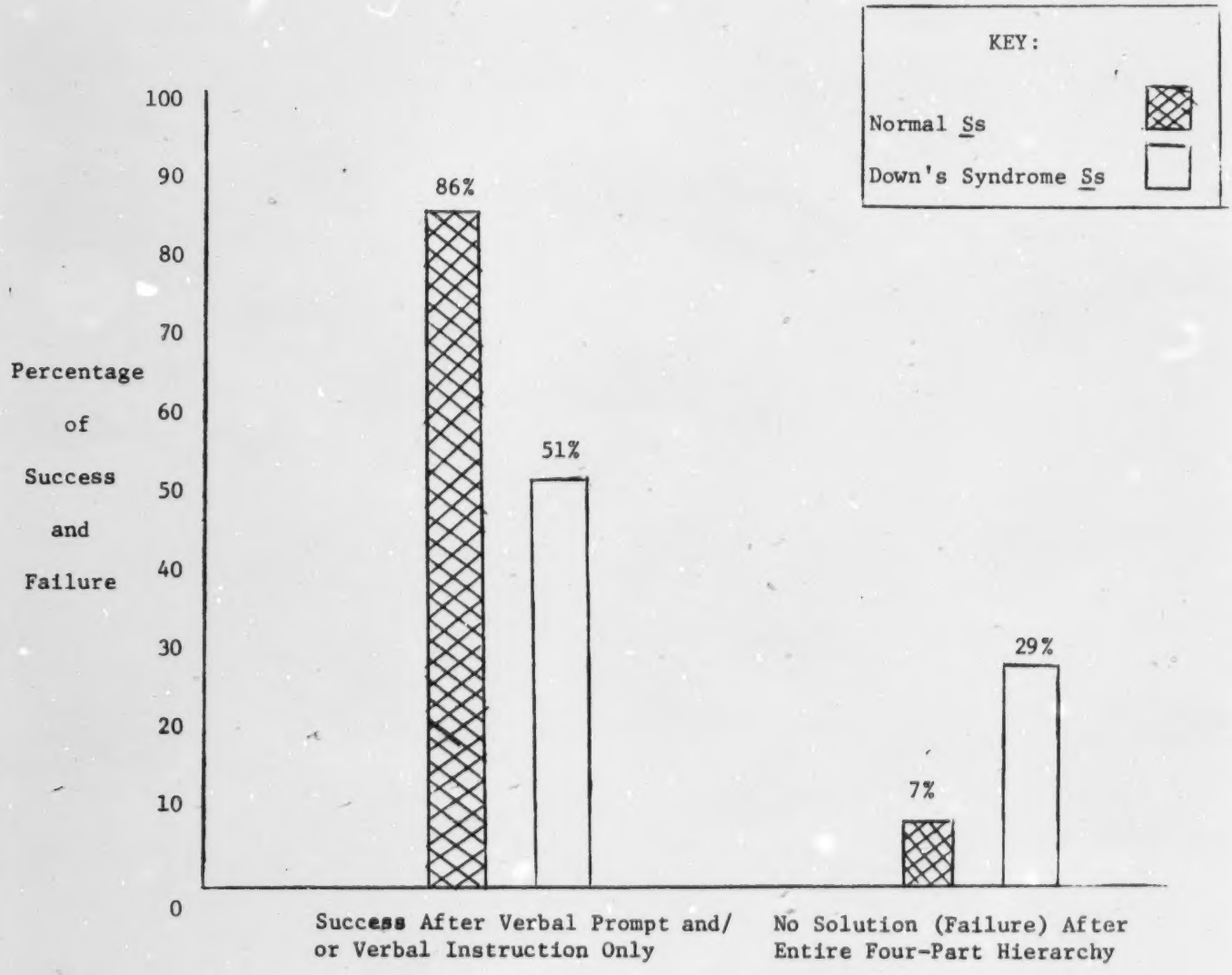
Figure I shows the percentage of tasks solved at a VP + VI level versus those not solved at all by Ss in the two groups. As can be seen, 86 per cent of the problems were solved by normal Ss at the VP + VI level while only 51 per cent of the tasks were solved by Down's Ss at the VP + VI level. Using a chi-square test of the difference between two independent proportions, successes of normal and Down's Ss (86% versus 51% respectively) under VP + VI were compared. This difference was significant at the .05 level of confidence.

With respect to non-solution, normal Ss left only 7 per cent of the tasks unsolved while Down's Ss left 29 per cent unsolved (see Figure 1). This difference was also significant at the .05 level of confidence.

Thus, Down's Ss have not only a relatively low rate of task acquisition following verbal prompting and verbal instruction they also have a fairly high rate of task failure despite having received a four-part hierarchy of instruction.

Figure 1

Success and Failure in Tasks of the EDGE Assessment



How did Down's Ss who received repeated verbal instruction only compare with those Down's Ss who received the hierarchial sequence?

Before addressing this question, we should point out that Down's Ss were entered into the present study as they became age-eligible and that the group of six, whose performance is about to be described, were the last group to be added. This departure from random assignment is not a problem as long as there is nothing systematic about their assignment which could bias the results (There was not since all of the last six were entered consecutively and without exception). But the other side of the assignment question, i.e., the question of whether the verbal-only group was a worthy contrast group in terms of entry characteristics remains to be shown. In other words, we needed to be certain that this contrast group would enter the task with ability to profit from verbal prompting and initial exposure to verbal instruction at a level comparable to or better than that of the hierarchial group.

As it turned out, this group reached criterion on EDGE Assessment tasks at the VP + VI level in 60 per cent of the tasks, as contrasted with 51 per cent criterion in the hierarchial group. Hence, it was apparent on an empirical basis that these six Ss were, indeed, a worthy contrast group. Then, what about non-solution in the two groups? Would repeated verbal instruction, where warranted by the nature of the task, produce better task solution than repeated hierarchial instruction where warranted?

Interestingly, task failure (non-solution) was approximately equal in both conditions in the present study (see Figure 2). Thus, in both Down's Syndrome groups, where verbal directions were either repeated three times, or repeated three times and augmented by modeling and manual guidance, task failure in both groups is at least 25 per cent (actually 29% in the hierarchial group and 26% in the verbal only group).

Regarding the statistical significance of success and failure rate comparisons of Down's Ss receiving repeated verbal instruction, these Ss do not show significant differences from Down's Ss receiving the four-part hierarchy. Success and failure rates are quite similar. And, therefore, both Down's groups are significantly different from normal Ss in terms of success and failure, i.e., both Down's groups succeed significantly less with VP +VI, and fail significantly more often either after repeated verbal instruction or a four-part hierarchy of instruction.

This is not to say however, that all Ss do not profit from either the four-part hierarchy or repeated verbal instruction. In this regard, it can be noted that normals, having reached criterion on 86% of the tasks at the VP + VI level, do attain solutions on 7% of the remaining 14% of the tasks during imitation and/or manual guidance instruction. Down's Ss in the four-part hierarchy group, having reached criterion on 51% of the tasks at the VP + VI level, attain solution on 21% of the remaining 49% of the tasks during imitation and/or manual guidance. And, Down's Ss in the repeated

verbal instruction condition having reached criterion on 60% of the tasks at the VP + VI level, attain solution on 14% of the remaining 40% of the tasks during repeated verbal instruction.

Should one wish to view the performances of the three groups in terms of their relative acquisition efficiency, one could look at performances using the following formula:

$$\text{Relative Acquisition Efficiency (RAE)} = \frac{\text{Failure \%}}{\text{Success \% (VP + VI)} + \text{Success \% (Imitation and Manual Guidance)}}$$

Substituting numerals we can compare the two Down's groups as follows:

$$\text{RAE} = \frac{29}{51 + 21} \text{ (Down's Hierarchy Group)}$$

$$\text{RAE} = 40\%$$

$$\text{RAE} = \frac{26}{60 + 14} \text{ (Down's Repeated Verbal Instruction Group)}$$

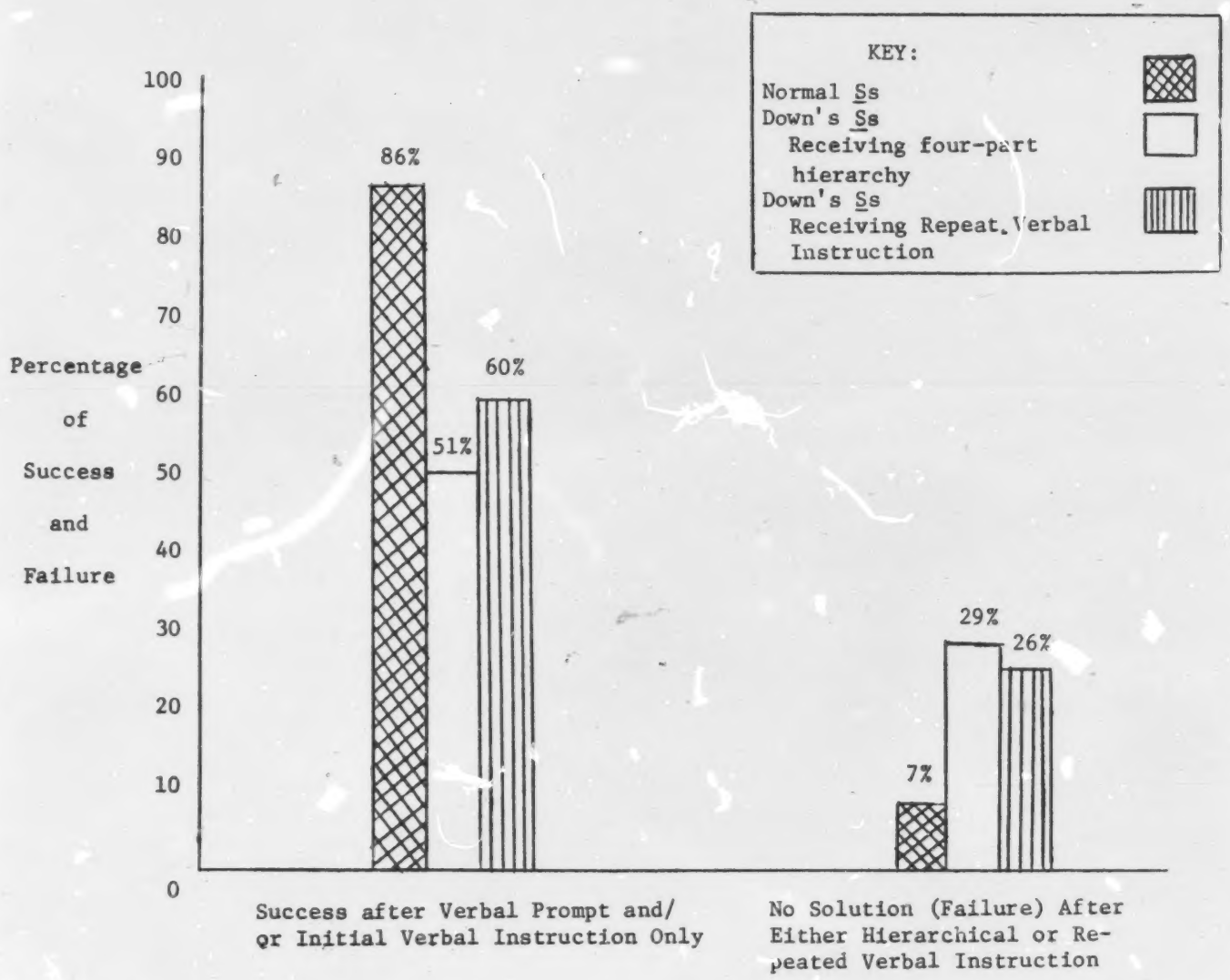
$$\text{RAE} = 35\%$$

The RAE of the Down's Hierarchy Group is 40% while the RAE of the Down's Repeated Verbal Instruction Group is 35%. These are, obviously, very close, slightly favoring the Hierarchial Instruction Group.

Looking at the RAE of normal adults in the hierarchy condition we find that their RAE is 75% ($\frac{7}{86 + 7}$), an efficiency approximately twice that of either Down's group.

Figure 2

Success and Failure in Tasks of the EDGE Assessment



DISCUSSION AND IMPLICATIONS

In this study, Down's Syndrome children clearly exhibited relatively severe verbal learning deficits, as revealed by the finding that approximately 40 - 50 per cent of the tasks were not solved by Down's Syndrome Ss with verbal prompting plus verbal instruction (VP + VI) alone. In contrast, only 14 per cent of the tasks were not solved by normal Ss at these same (VP + VI) levels of instruction.

A more intensive look at the performance of Down's Ss in the hierarchical instructional situation indicates that, despite having 22% more trials, without numerical or task penalty, to achieve task solution than normals, they had a failure (non-solution) rate more than four times (29% versus 7%) greater than normal Ss. This is particularly disturbing inasmuch as (a) verbal instruction was always added never subtracted from imitation and manual guidance presentations, (b) imitation and manual guidance strategies can be relatively powerful stimulus conditions, and (c) the tasks were typical nursery school tasks, many of which had a very low level academic orientation, i.e., they were not contrived laboratory-type tasks with a high cognitive orientation. Nevertheless, despite the additional trials, which were both enriched with verbal instruction as well as made more direct through the use of imitation and manual guidance strategies, Down's Ss failed to acquire task solution more than 25 per cent of the time.

Furthermore, examining the performance of individual Down's children reveals that not a single child out of the entire group of 20 in the study performed across the 16 tasks without at least one instance of non-solution,[two Ss had at least 50 per cent (8 out of 16) non-solution, and 13 Ss had 25 per cent on greater non-solution]. In contrast, three of the eight normal Ss turned in errorless performances, and only one S showed more than two instances of non-solution.

In interpreting the results of the present study one should not disregard the fact that response measures were motor responses. In this regard, tasks were purposely designed to minimize the motor requirements, i.e., requiring motor abilities that are found in standardized tests for normal children of 18 months or less, and pilot testing was done to reduce motor requirements even further. Nevertheless, the fact remains that verbal learning measures require a response which is measurable; for the older child, the response measure is usually verbal output; in our case, the measure was motor output. Thus, the verbal learning deficits described in the present study could be described as auditory - motor deficits (Scheffelin, 1968). We are emphasizing this point because the term, verbal learning, can encompass a number of sensory - motor processes, many of which occur in combination (e.g., auditory - vocal, visual - motor - vocal, etc.).

On an empirical basis, as we look at the rates of non-solution, across tasks in Down's Ss, we observe that tasks involving the more

difficult motor manipulations, e.g., piling blocks and putting puzzle pieces in insets, tend to show greater rates of non-solution. On the other hand, this tendency is far from clear since one of the highest non-solution rates for Down's children occurs in the color recognition task, requiring only the dropping of a red plastic chip into a red box with a large opening at its top. Thus, it seems safe to say that the verbal learning deficits manifested in the present investigation lie largely in the auditory and/or integration phases of the problem and only minimally in the motor output phase.

Besides, the problem of interpreting present findings in the light of motor requirements, one must also look at the language requirements placed on the child. In this regard, might the Down's child fail in a task because of vocabulary deficits, e.g., he doesn't comprehend the word "most?" Yes, of course he could fail because of a limited vocabulary, even though a deliberate attempt was made to minimize vocabulary requirements per se. He might also fail because of inadequate understanding (internalization) in interpreting intonational variations (stress, pitch, juncture). Our belief is that failure in verbal learning tasks reflects a co-influential amalgam of sensorimoter, as well as language, cognitive, and social deficits, not just a simple breakdown in one area. The task of the researcher therefore, is to minimize the compounding (and possibly confounding) possibilities in a verbal learning task, without, at the same time, ignoring their ever-presence and influence.

What implications can we draw from these findings as educators and behavioral scientists?

First, we can be certain that Down's Syndrome children -- and probably other retarded children as well, since there is little reason to believe that Down's children have different learning characteristics that other moderately and severely retarded children -- have severe, and probably compounded, verbal learning deficits. Therefore, as educators we should not assume that verbal instruction will be sufficient to induce task acquisition in retarded children, nor, as this study shows, can we assume that even more direct (e.g., imitation and manual guidance) methods of instruction will always suffice.

If changing instructional strategies is not completely effective, to what else can the teacher of retarded children turn? Possibly, part of the answer lies in instructional aspects not included in the present study, some of which follow:

Obviously, one of the first things that one might attempt if initial verbal instruction failed, would be to make the verbal instruction more powerful. In this vein, perhaps for the Down's children in the present study some of the words used in the verbal instructional tasks were not meaningful, or perhaps, if meaningful, they were not, for them, linked together syntactically. In order to rectify this problem the child could receive practice in motor tasks where vocabulary and syntax would be linked together in an interesting fashion. Rynders and Horrobin

(1972) are experimenting with just such a program for Down's Syndrome infants, as are the Brickers with disadvantaged and retarded preschool children (Bricker and Bricker, 1973). Then, too, one might augment verbal instruction with gestural language (signs, fingerspelling) or rebuses. We've done this with some success in Project EDGE.

Perhaps, too, an instructor might teach distinctive motor cues or movements to each object in a task or task sequence so as to form a bridge to verbal labels for the objects. Bricker (1972) has used this technique (imitative sign training) and found that it facilitated the learning of word-object associations.

The educator might also employ instructional strategies which were not used in the present study. For example, behavior modification techniques, such as shaping and backward chaining have demonstrated their value with severely retarded individuals (cf., Brown and Sontag, 1972; Bensberg, 1965).

Possibly, an educator might add the weapon of alternative instructional modes, to her armamentarium of teaching techniques. For example, the vending of instruction through operant learning devices which provide immediate feedback (e.g., the PLAYTEST device of Friedlander, 1969) can be helpful.

Increasing the reinforcement value of the task itself could be attempted, as could the offering of some external reinforcer, e.g., token, edible, social praise, or alternate reinforcing activity. Manipulation of reinforcers and reinforcement conditions has proven its worth in several studies with severely retarded individuals (cf., Heber, 1964).

A second implication of the present study takes the form of a caution -- a caution that a popular way of instruction, namely group instruction, may miss the mark to a great extent with some moderately and severely retarded children. This implication is based on the data from the present study in which Down's children received repeated verbal instruction or augmented verbal instruction on a one-to-one basis and still showed more than 25 per cent failure in task acquisition. One wonders what happens to acquisition in some classrooms where group verbal instruction is used heavily. The combination of heavy reliance on verbal instruction in a grouped fashion could be very ineffectual for at least some moderately and severely retarded children.

Third, implied in the present study, is an admonition to educators to begin communication stimulation early for Down's Syndrome and other organically retarded children because of the possible extreme importance of providing stimulation in the preverbal period. Exploration activities, eye-hand coordination opportunities, availability of circumstances to act on the environment, and other early opportunities appear to be extremely important to the young normal child's communication development (c.f., Piaget, 1962; Schlesinger, 1971); for the Down's Syndrome child, early education may be critical in maximizing verbal learning ability.

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APPENDIX A

EDGE ASSESSMENT

General Directions:

Because this measure will be administered to several groups which are widely separated by distance, it is essential that it be given in a room that can be duplicated in size, furnishings, etc., elsewhere. Furthermore, the familiarity dimension must be equated across groups. Therefore, select an appropriate room which is unfamiliar to the child, remove all furnishings except the ones you feel are necessary, and then describe the room (dimensions, etc.) and list the furnishings and their positions in the room (a floor plan drawn from a top view is the way to do this).

Verbal Prompt

For some tasks, the child will be offered a chance before verbal instruction to solve the problem spontaneously. A chance for spontaneous solution is provided only in the instances where the task itself suggests the full and complete solution (items 4,5,6,8,9,10,11,12,13,14, and 16). In these cases, arrange the task elements out of the child's reach, push them in front of him and say, "go ahead." (Wait 15 seconds for him to respond. If he does it correctly, terminate that task. If he does not perform correctly, go on to verbal instruction.)

Position Bias:

In tasks 3,5,7,11, and 15 there is a chance for position bias (side preference). In these tasks, the materials should be alternated within the array of task strategies and across tasks.

Directions to Observer (O) :

The teacher (T) will present the child (C) with the task, following the description given her on the form, then she will ask C for the desired response. Use a stop watch. Allow C 15 seconds to complete each task, except the Problem Solving Task for which 30 seconds are allowed for completion. Say "Stop" when the time is up.

If C does not perform successfully, T will continue with the next learning procedure and repeat the task. Each time that C does not rate a (+) after being asked for the response, T will continue with the next level of teaching until she has exhausted all four. It is your responsibility to indicate to T when you feel that C rates a perfect score. Signify this to T by raising your hand and she will then go on to the next task. All sessions are to be video-taped.

Directions to Teacher (T):

It is important that you follow a prescribed sequence in administering this assessment device. Each testing situation is divided into sections, each testing a different skill. These skills will be tested using different teaching methods. For the sake of consistency, you are to read the directions to the child (C) for each task. After each teaching strategy, verbal prompt, verbal instruction, imitation, and manual guidance, the materials used in each task will be drawn away from C, across the table to T. This will direct the C's attention toward T and the directions being given, and it will facilitate the changes in the position of the stimulus materials to avoid position bias. Follow the directions printed on each page of the recording sheet very carefully.

Task Closing door.

Verbal Instruction

(The door to the room should be open. Stand with C next to the door.) Say, "Listen to me carefully and I will tell you what to do. Close the door."

Imitation

(Remain standing near the door.) "Watch me carefully and I will show you what to do. See, I am closing the door. Now you do it."

Manual Guidance

(Remain standing with C near the door.) "I will help you. I am helping you close the door. Now you do it."

V.I.	I.	M.G.

Total Response: C closes door so that it remains shut.

Task Hanging clothing.

Verbal Instruction

(Hand C his jacket or sweater.) "Listen to me carefully and I will tell you what to do. Hang your jacket on the hook."

Imitation

"Watch me carefully and I will show you what to do. I am hanging your jacket on the hook." (Hand C his jacket.) "Now you do it."

Manual Guidance

"I will help you. I am helping you hang your jacket on the hook." (Hand C his jacket.) "Now you do it."

V.I.	I.	M.G.

Total Response: C attaches coat to hook so that it hangs from hook.

Task Concept of size.

Verbal Instruction

(Position the big box on C's right.) "Listen to me carefully and I will tell you what to do. Drop this chip into the big box." (Hand chip to C.)

Imitation

"Watch me carefully. I will show you what to do. I am dropping this chip into the big box." (Position big box on C's left.) "Now you do it."

Manual Guidance

"I will help you. I am helping you drop this chip into the big box." (Position big box on C's right.) "Now you do it."

V.I.	I.	M.G.
R	L	R

Total Response: C drops the chip into the big box.

Task Squeezing a toy.

Verbal Prompt

(Push the squeeze toy in front of C.) "Go ahead."

Verbal Instruction

"Listen carefully and I will tell you what to do. Squeeze the toy so it makes a noise."

Imitation

"Watch me carefully and I will show you what to do. I am squeezing the toy so it makes a noise. Now you do it."

Manual Guidance

"I will help you. I am helping you squeeze the toy so it makes a noise. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response : C squeezes toy so it makes a noise.

Task Matching shapes.

Verbal Prompt

(Place board with round inset on C's left. Push the form board and round shape in front of C.) Say, "Go ahead."

Verbal Instruction

(Show C the round block.) "Listen to me carefully and I will tell you what to do." (Place board with round inset on C's right.) "Put this block into the hole where it fits."

Imitation

"Watch me carefully. I will show you what to do. I am putting the block into the hole where it fits." (Place board with round inset on C's left.) "Now you do it."

Manual Guidance

"I will help you. I am helping you put this block into the hole where it fits." (Place board with round inset on C's right.) "Now you do it."

V.P.	V.I.	I.	M.G.
L	R	L	R

Total Response: C places round shape partially on or completely in the correct hole.

Task Playing the piano.

Verbal Prompt

(Push a toy piano in front of C.) "Go ahead."

Verbal Instruction

"Listen to me carefully and I will tell you what to do. Push down the piano keys one at a time."

Imitation

"Watch me carefully and I will show you what to do. I am pushing down the piano keys one at a time. Now you do it."

Manual Guidance

"I will help you. I am helping you push down the piano keys one at a time. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response: C presses down the keys of the piano, one at a time, so that the piano makes a sound.

Task. Color recognition.

Verbal Instruction

(Place three boxes that are the same size but different colors in front of C. Place the correct response on C's left. Hold the chip in your hand so C can see it.) "Listen to me carefully, and I will tell you what to do. Drop the red chip into the red box." (Hand C the chip.)

Imitation

"Watch me carefully and I will show you what to do. I am dropping the red chip into the red box." (Place correct response on C's right. Hand C another chip.) "Now you do it."

Manual Guidance

"I will help you. I am helping you drop the red chip into the red box." (Place the correct response on C's left. Hand C another chip.) "Now you do it."

V.I.	I.	M.G.
L	R	L

Total Response: C drops the red chip into the red box.

Task Pegboard.

Verbal Prompt

(Push pegboard in front of C and hand C a peg making sure C is holding onto the big end.) "Go ahead."

Verbal Instruction

(Give C one peg making sure he is holding onto the big end.) "Listen to me carefully and I will tell you what to do. Put the peg into a hole."

Imitation

"Watch me carefully and I will show you what to do. I am putting the peg into a hole." (Give C one peg making sure he is holding onto the big end.) "Now you do it."

Manual Guidance

"I will help you. I am helping you put the peg into a hole." (Give C one peg making sure he is holding onto the big end.) "Now you do it."

V.P.	V.I.	I.	V.G.

Total Response : C puts the peg into a hole in the pegboard.

Task Crayon Choosing.

Verbal Prompt

(Place a box of crayons in front of C.) "Go ahead."

Verbal Instruction

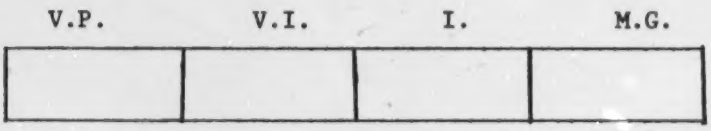
"Listen carefully, and I will tell you what to do. Take a crayon out of the box."

Imitation

"Watch carefully, and I will show you what to do. I am taking a crayon out of the box. Now you do it."

Manual Guidance

"I will help you. I am helping you take a crayon out of the box. Now you do it."



Total Response: C takes a crayon out of the box.

Task Crayon Drawing.

Verbal Prompt

(Remove the box of crayons, leaving the one C has chosen and one for T. Place a sheet of paper in front of C.) "Go ahead."

Verbal Instruction

"Listen carefully, and I will tell you what to do. Make a line on your paper with the crayon."

Imitation

"Watch me, I will show you what to do. I am making a line on your paper with the crayon. Now you do it."

Manual Guidance

"I will help you. I am helping you make a line on your paper. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response: C makes any type of line longer than a dot on his paper with the crayon.

Task Memory.

Verbal Prompt

(Place in front of C three over-turned boxes. While C is watching, place a kitten under the box on C's right.) "Go ahead."

Verbal Instruction

(Place the correct response on C's left.) "Listen carefully, and I will tell you what to do. Pick up the box that has the kitty."

Imitation

"Watch carefully, and I will show you what to do. I am picking up the box that has the kitty." (Place the correct response on C's right.) "Now you do it."

Manual Guidance

"I will help you. I am helping you pick up the box that has the kitty." (Place the correct response on C's left.) "Now you do it."

V.P.	V.I.	I.	M.G.
R	L	R	L

Total Response: C picks up the correct box first to find the kitty.

Task Block Building.

Verbal Prompt

(Place three blocks in front of the child.) "Go ahead."

Verbal Instruction

"Listen carefully, and I will tell you what to do. Pile the blocks on top of each other."

Imitation

"Watch me carefully, and I will show you what to do. I am piling the blocks on top of each other. Now you do it."

Manual Guidance

"I will help you. I am helping you pile the blocks on top of each other. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response. C places all three blocks on top of each other.

Task Problem Solving.

Verbal Prompt

(Place the puzzle in front of C. Make sure that C sees the puzzle. Take the puzzle apart.) "Go ahead."

Verbal Instruction

"Listen carefully, and I will tell you what to do. Put all of the pieces in the puzzle."

Imitation

"Watch carefully, and I will show you what to do. I am putting all of the pieces in the puzzle. Now you do it."

Manual Guidance

"I will help you. I am helping you put all the pieces in the puzzle. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response: C puts all of the puzzle pieces together so they fit into or touch the correct spaces.

Task Hammering.

Verbal Prompt

(Place Pound-A-Peg with one peg and a hammer in front of C.) "Go ahead."

Verbal Instruction

"Listen carefully, and I will tell you what to do. Pound the peg with the hammer."

Imitation

"Watch carefully, and I will show you what to do. I am pound ng the peg with the hammer. Now you do it."

Manual Guidance

"I will help you. I a.. helping you pound the peg with the hammer. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response: C hits the peg with the hammer at least three times.

Task Quantity.

Verbal Instruction

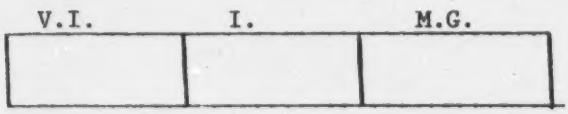
(Place in front of C two clear plastic jars, one containing two blocks and one containing fourteen blocks. Place correct response on C's right. Hand C a chip.) "Listen carefully, and I will tell you what to do. Drop this chip in the jar with the most blocks."

Imitation

"Watch carefully, and I will show you what to do. I am dropping this chip in the jar with the most blocks." (Place the correct response on C's left. Hand C another chip.) "Now you do it."

Manual Guidance

"I will help you. I am helping you drop this chip in the jar with the most blocks." (Place the correct response on C's right. Hand C another chip.) "Now you do it."



Total Response: C drops the chip in the jar with the most blocks.

Task Pouring Juice.

Verbal Prompt

(Place in front of C a pitcher of juice and a cup on a tray.) "Go ahead."

Verbal Instruction

"Listen carefully, and I will tell you what to do. Pour the juice into your cup."

Imitation

"Watch carefully, and I will show you what to do. I am pouring the juice into your cup. Now you do it."

Manual Guidance

"I will help you. I am helping you pour the juice into your cup. Now you do it."

V.P.	V.I.	I.	M.G.

Total Response: C picks up the pitcher and pours some of the juice into his cup.

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